



Armed Forces College of Medicine AFCM



Digestive System

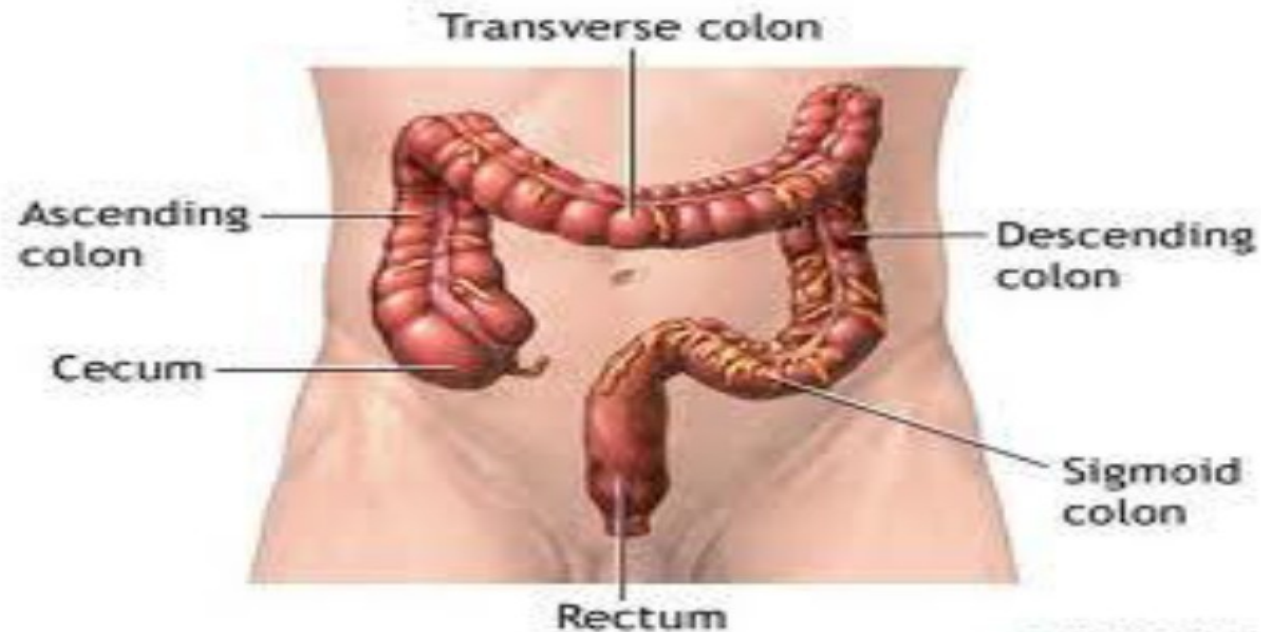
Large Intestinal

Motility

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Motility of Large intestine



INTENDED LEARNING OBJECTIVES (ILO)



After studying this, you should be able to

List the **types of motility in the colon** (haustral -1
.contractions and mass movements)

Explain **how motility patterns of the colon** -2
subserve its function to desiccate and evacuate
.the stool

Explain the physiological significances of the -3
.gastroileal and gastrocolic reflexes

4- Explain **how gastrointestinal motility changes during fasting** (MMC)

5- Describe **defecation reflex** and its control.

Interpret the causes and consequences of -6



Lecture Plan



1. Part 1 (5 min) **Introduction to types of intestinal motility**
2. Part 2 (35 min) **Main lecture:**
 1. **Colonic motility**
 2. **Defecation reflexes**
 3. **Abnormal intestinal motility**
3. Part 3 (5 min) **Summary**
4. **Lecture Quiz (5 min)**

Movements of the :colon

Haustral contractions .1
(**haustrations**): are **mixing**
.movements

:Mass movements .2
are **propulsive**

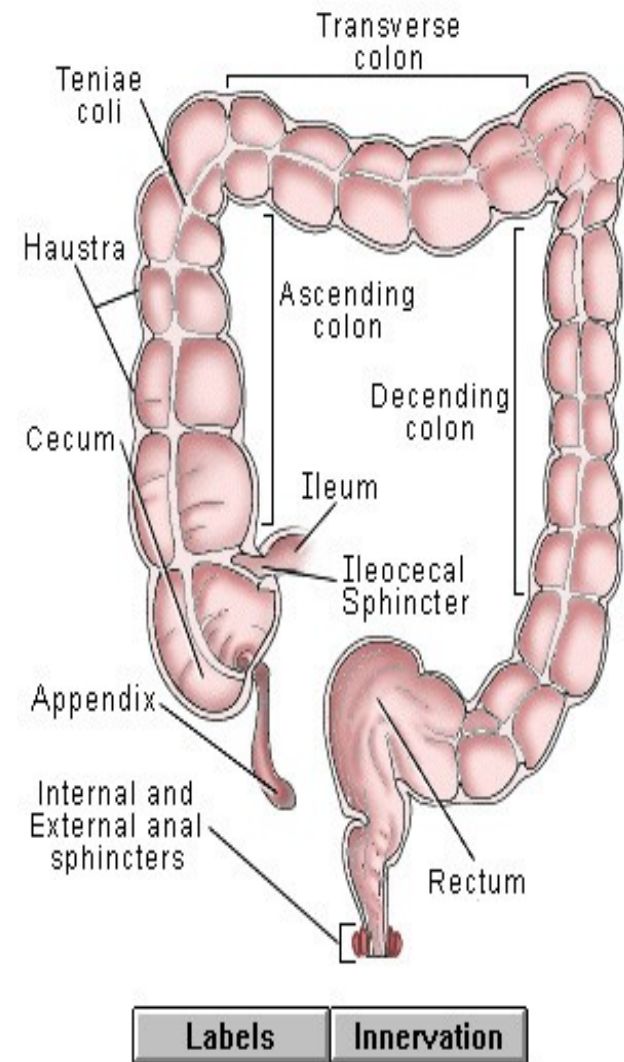


Transverse contractions (Haustrations) -1 (Peristaltic Movement)

- The outer longitudinal smooth muscle layer of the colon is collected into 3 separate longitudinal strips called **taeniae coli**, which are shorter than the underlying circular smooth muscle and mucosal layers.

Because of this, the underlying layers bulge outward into baglike sacs (or pouches) called **haustra**.

- Contraction of the circular smooth muscle actively changes the location of haustra.



Haustrations: are the colon's primary motility.

- Initiated by the autonomic pace-maker cells in large intestine, that produce **slow wave potentials**. When they reach threshold, action potentials are initiated, followed by haustral contractions.

- **Similar to small intestine segmentations**, but are **less frequent**. The location of the haustral sacs gradually changes as a relaxed segment that has formed a sac slowly contracts while a previously contracted area simultaneously relaxes to form a new sac.



Function of :haustrations

Slowly move the colonic contents in a back .1 and forth **mixing movement**. This exposes the colonic contents to the absorptive .mucosa, thus helps absorption

:Because they are slow and non-propulsive .2
.help storage of feces -
allow sufficient time for bacteria to grow -
and accumulate in the large intestine (most
.colonic micro-organisms are harmless)



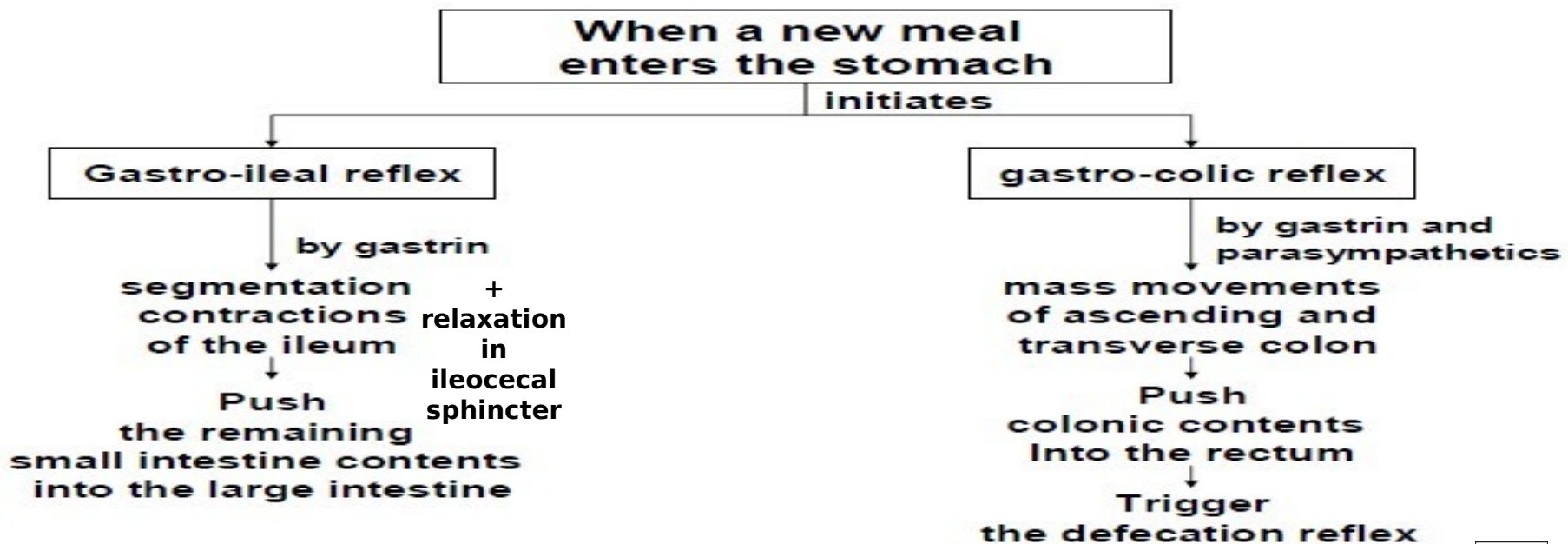
movements (Propulsive Move

- Occur 3-4 times/day, generally after meals, but, in most people, occur after eating breakfast (1 time/day).
- **Simultaneous, strong contractions** of **large segments** of the **ascending and transverse colon**, forcing the colonic contents into the distal part of the large intestine, where material is stored until defecation occurs.
- A whole series of mass movements usually persist for 10-30 minutes.



:Gastro-colic reflex

- .initiated by the arrival of new food to the stomach -
- :Mediated by -
 - .gastrin *
 - .parasympathetic nerves *
- in many people, this reflex occurs mostly after the -
 - .first meal of the day (breakfast)
 - .is often followed by the urge to defecate -



* These reflexes are initiated to move the contents down the tract to make way for the new incoming food



Migrating motility complex (MMC): intestinal house keeper:

During Fasting

Consists of weak, repetitive **peristaltic waves** that move -
.a short distance down the intestine

Is regulated by hormone **motilin** which **increases** -
intensity of MMC

Starts at the stomach, migrates to the end of small intestine -
within 1.5 to 2.5
hours.

- Function:

Clear stomach and small intestine of luminal contents

□ **Between meals** (i.e., during fasting between
periods of digestion), segmentation contractions
.are replaced by migrating motility complex

□ **When the next meal arrives: migrating motility
complex ceases, and segmentation contraction is**



Colonic motility (Quiz)



Choose:

Mass movements represent the
(propulsive movement - mixing movement) of the
colon, is initiated by..... (Motilin -
Gastrocolic reflex)

:Defecation reflex

When mass movements of the colon
move fecal material

:into the rectum, this results in

- .□ distension of the rectum
- stimulate **stretch receptors** in the rectal
.wall
- stimulate defecation **center** in the **sacral
.segment of spinal cord**
- via parasympathetic (in **pelvic nerves**)
causes: **contraction** of rectum and
relaxation of internal anal sphincter
- .□ **conscious urge to defecate**



Voluntary control of defecation

:If the condition is favorable for defecation -

Cerebral cortex causes: voluntary relaxation of the external anal sphincter thus, defecation occurs

:If the condition is unfavorable for defecation -

Cerebral cortex causes: voluntary contraction of the external anal sphincter that can prevent defecation, despite the defecation reflex

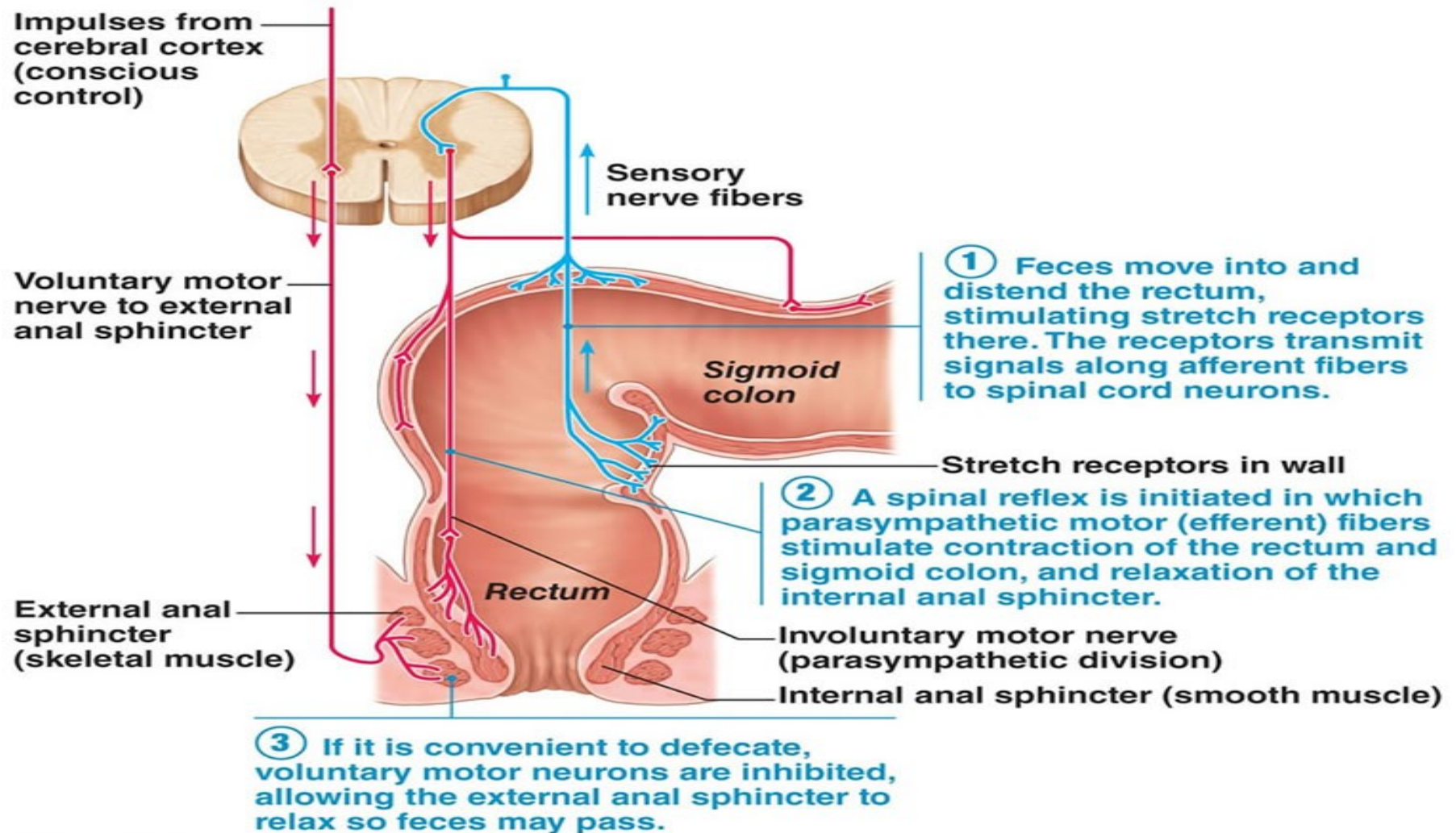
When defecation occurs, it is assisted by*

:voluntary straining movements, as follows

□ simultaneous, voluntary contraction of the abdominal muscles and a forcible expiration against a closed glottis



Defecation reflex and its voluntary control



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**Normal, frequency of defecation: ranges *
.from 3 / day - 1 / week**



Defecation reflexes (Quiz)



Defecation:

- a- Can be delayed by contraction of abdominal and thoracic muscles.
- b- Reflex is abolished following brain injury involving cerebral cortex.
- c- Reflex is activated when colonic contents enter the rectum.
- d- Reflex involves simultaneous contraction of ascending and transverse colon.
- e- Reflex is initiated following a meal by gastroileal reflex.

Constipation and) (Diarrhea



Constipation

- **Definition:**

It is the passage of hard and dry feces with delayed defecation.

- If defecation is delayed too long:
colonic contents are retained for longer period of time
than normal → more H_2O is absorbed than usual → feces
becomes hard
.and dry (i.e., constipation)

:Symptoms

Abdominal discomfort, dull headache, loss of -
appetite sometimes accompanied by nausea, and
.mental depression



Constipation

:Causes

1. Ignoring the urge to defecate.
2. Decreased colonic motility accompanying:
 - **aging**,
 - **emotional stress** and a
 - **low bulk diet** (by decreased dietary fibers in diet).
3. Obstruction of fecal movements in the large intestine caused by colonic spasm or local tumor in the colon.
4. Impairment of the defecation reflex.



Diarrhea

• Definition:

It is passage of a highly fluid fecal matter with increased frequency of defecation.

- The intestine is unable to absorb fluid as extensively as normal. As a result, extra unabsorbed fluid passes out in the feces.

• Effect of diarrhea:

a. Beneficial effects: hastens the elimination of
.harmful materials from the body

:b. Harmful effects

.loss of the nutrient materials -

:loss of the secreted juice -

Loss of **H₂O** causes dehydration and decreased plasma*

.volume□ decreased blood pressure and circulatory shock

Loss of **HCO₃⁻** : in feces□ decreased plasma HCO₃⁻ and*



Diarrhea

:Causes

Increased small intestinal motility (the most **.1**
:common cause) caused by
.local irritation by bacterial or viral infection -
.emotional stress (i.e., psychogenic diarrhea) -

Excess osmotically active particles in the lumen of **.2**
the intestine, **e.g., laxative as magnesium**
.sulphate or deficiency of lactase enzyme

:deficiency of lactase enzyme causes *

□ accumulation of undigested lactose in the intestinal lumen (i.e., increased osmotic pressure) □ excessive fluid enters and retains in the intestinal lumen □
.increased fluidity of feces, causing diarrhea



Diarrhea

:Causes

:Toxins of the bacterium *Vibrio cholera* lead to .3
□ excessive secretion of electrolytes and fluids, from the crypts of Leiberkuhn in the distal ileum and colon□ increase osmotically active particles in intestinal lumen□ excessive fluid enters the intestinal lumen□ increased fluid in feces, resulting in profuse .diarrhea

Physiologic basis for therapy in*** :cholera

replace the lost fluid and electrolytes by intravenous - saline (Na^+) and glucose, or by oral administration of Na^+ and glucose (oral rehydration therapy), so that the Na^+ is absorbed via the Na^+ glucose cotransporter



Abnormal intestinal motility (Quiz)



Osmotic diarrhea could occur as result of:

- a- Food poisoning.
- b- Lactase deficiency.
- c- Stressful situation.
- d- Using laxatives.

e-Both b and d



Summary



- Colonic movement includes mixing haustral movement controlled by local reflex and propulsive mass movement initiated by gastrocolic reflex.
- In the period between meals, the intestine is relatively quiescent, but every 90 min or so it is swept through by a large peristaltic wave triggered by the hormone motilin. This migrating motor complex presumably serves a “housekeeping” function.
- Defecation reflex is a spinal sacral reflex initiated by stretch of rectal wall by its content, under voluntary cortical control.

SUGGESTED TEXTBOOKS



1. Ganong's review of medical physiology

25th edition

2. Sherwood 9th edition

A background image of a field of purple flowers, possibly globe amaranths, with a soft, out-of-focus green and yellow background. The flowers are in various stages of bloom, with some in sharp focus in the foreground and others blurred in the background.

THANK YOU

Rangan Das

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